

Forest Quality Assessment Summary Report

Kenton County, Kentucky

October, 2004

***Forest Quality Assessment
Summary Report
Kenton County, Kentucky***

October, 2004

Prepared for
Northern Kentucky Urban and Community Forestry Council
Boone County Extension Office
6028 Camp Ernst Road
Burlington, Kentucky 41005

Prepared by
Davey Resource Group
11018 Harrison Way
Walton, Kentucky 41094
859-384-8258

Acknowledgements

This forest canopy cover assessment was made possible by the generous support of the following:

Greater Cincinnati Foundation



U.S. Forest Service



Northern Kentucky Area Planning Commission



Kentucky Division of Forestry



Table of Contents

Executive Summary.....	ii
Introduction	1
Methodology	1
Acquisition of Available Secondary Source Data	1
Initial Field Reconnaissance.....	2
Identification of Forest Canopy Cover.....	2
Determination of Forest Canopy Crown Size	2
Final Field Reconnaissance.....	3
Assessment Limitations	3
Data Summaries and Findings.....	3
County Summaries	3
Watershed Summaries.....	4
Municipal and Unincorporated Area Summaries.....	5
Discussion	7
General Forest Quality	7
Small Crown Forests.....	7
Medium Crown Forests.....	8
Large Crown Forests.....	9
Historical Comparisons	10
2003 U.S. Forest Service Forest Inventory and Analysis Program.....	11
Conclusion.....	12

Tables

1. Canopy Cover Crown Class Size	2
2. Forest Canopy Coverage in Kenton County	3
3. Forest Canopy Coverage in Kenton County by Watershed and Crown Size.....	4
4. Forest Canopy Cover in Kenton County by Government Unit.....	5

Appendices

- A. Field Verification Sites Map
- B. Representative Photographs of the Field Verification Sites
- C. Forest Quality Assessment Map
- D. Watershed Boundaries Map
- E. Municipality Boundaries Map
- F. USFS FIA Report
- G. Davey Resource Group Personnel Profiles

Executive Summary

The forest quality assessment of Kenton County, Kentucky identified the extent and relative quality of the County's urban and rural forest canopy cover. The identification and the location of significant areas of forest cover and the determination of their relative quality creates a baseline of forest resource data for Kenton County.

The major findings include the following:

- Kenton County has approximately **43,340 acres of forest cover**, representing 41% of the total land in the county.
- The **small crown** class is comprised of 26,997 acres, representing 62% of the total canopy cover and 26% of the land area.
- The **medium crown** class is found on 14,539 acres, representing 34% of the total canopy cover and 14% of the total land area.
- The **large crown** class is found on 1,804 acres, representing 4% of the total canopy cover and 2% of the total land area within the county.
- The majority of forest cover (25,449 acres; 59%) is found in **unincorporated areas**; the remaining forest cover (17,891 acres; 41%) is found in the **municipalities**.
- These statistics also indicate that, as a whole, the **municipal areas are 36%** forested and the **unincorporated areas are 46%** forested.
- The **municipalities** with the most acreage of forest canopy cover include: Independence (3,675 acres; 32%); Covington (3,096 acres; 36%); Ryland Heights (2,225 acres; 65%); Erlanger (2,002 acres; 37%); and Taylor Mill (1,899 acres; 49%).
- The **municipalities** with the least acreage of forest canopy cover include: Kenton Vale (15 acres; 45%); Visalia (23 acres; 14%); Lakeside Park (50 acres; 10%); Walton (65 acres; 29%); and Latonia Lakes (77 acres; 46%).
- The **watersheds** with the highest percentage of forest canopy cover include: Little Cruises Creek (62%); Steep Creek (59%); and Bowman Creek (57%).
- The **watersheds** with the lowest percentage of forest canopy cover include: McCoys Fork (19%); Wolf Pen Branch (20%); and Ohio River (26%).

Introduction

Kenton County is experiencing rapid development accompanied by accelerated conversion of open areas and wooded hillsides to more urban uses. Rural scenic vistas, vast forests, and fields of open space, along with the economic benefits these natural resources provide, are being removed from the landscape and replaced with urban expansion and the associated economic benefits of development.

An increasing awareness of the need to protect natural ecosystems and maintain tree cover exists, as these resources are viewed as the key to sustaining a natural part of community infrastructure within the built environment. The urban and rural forest resources in Kenton County were studied and documented to assist Kenton County leaders, developers, and citizens in evaluating the results of growth and the quantity, quality, and location of canopy cover. This *Forest Quality Assessment of Kenton County, Kentucky* was commissioned by the Northern Kentucky Urban and Community Forestry Council.

An inventory and analysis of forest resources is the basis for establishing reasonable policies affecting land use and making informed decisions during land development. This information can assist many people in making a variety of decisions. For example, it can be used to develop site design criteria, to consider growth management strategies, and to prioritize lands for parkland and greenway acquisition.

The forest quality assessment and analysis identified the extent and relative quality of the urban and rural forest canopy cover in Kenton County. Data generated by this study can be used to identify land areas with unique forest characteristics and to quantify the environmental and economic benefits of the County's urban, suburban, and rural forests using other data analysis tools. The primary results of this study are the identification and the location of significant areas of forest cover and the determination of their relative quality to create a baseline of forest resource data.

Methodology

Davey Resource Group complied with the methodology, mapping, delivery formats, protocols, and standards specified in the Council's Request for Proposal dated November 1, 2003. The majority of this study's methodology was determined by a previous study of Boone County canopy cover performed by the Northern Kentucky University's Center for Applied Ecology and further refined by the Council.

Specifically, the following tasks were performed to complete the Forest Quality Assessment for Kenton County, Kentucky.

Acquisition of Available Secondary Source Data

Davey Resource Group acquired historical aerial photographs from the Kenton County Natural Resource Conservation Service, current digital orthophotographs, and other Kenton County Geographic Information Systems (GIS) data such as soils, topography, drainage, parcel boundaries, subwatershed boundaries, and municipal boundaries from the Northern Kentucky Area Planning Commission.

Initial Field Reconnaissance

After reviewing all available secondary source data, natural resource scientists, including a *Certified Arborist* and a *Certified Forester*, made field inspections of publicly accessible sites in Kenton County. A variety of sites were chosen for inspection to gather information on the forest types in the County and to locate examples of the crown size classes in the field. A global positioning system (GPS) was used to locate and precisely map the specific forest canopy cover areas examined.

The locations of the field verification sites are shown in Appendix A. Photographs of some field verification sites are shown in Appendix B.

Identification of Forest Canopy Cover

The 1999 orthophotographs were analyzed by qualified natural resources scientists and *Certified Arborists* to determine the location of forest tracts with a minimum of 10% tree canopy covering five acres or more within Kenton County. This analysis included digitizing the forest units for later GIS analysis.

Determination of Forest Canopy Crown Size

Once the forest tract locations were determined, each forest unit was evaluated for their presumed ecological quality based on crown size class as specified in the methodology prescribed by the Council. The Council required using the parameters shown in Table 1.

Table 1. Canopy Cover Crown Class Size

Crown Class Size	Diameter Breast Height (dbh) (Inches)
Small	Less than 12"
Medium	12" to 18"
Large	Greater than 18"

Crown size of the forest canopy was determined by a detailed analysis of the 1999 orthophotographs and a general analysis of the paper format aerial photographs from the 1950s. In addition, the initial field data gathered assisted the natural resources scientists in accurately determining crown size classes. The analysis of the historic aerial photography was performed to identify qualitative positive and negative trends in the forest canopy cover countywide over time.

Successional forested tracts with only 1- to 4-inch diameter trees mixed with shrub understory vegetation were not included in the analysis. Forested tracts with a mix of crown sizes were classified using the predominant crown class. Adjacent tracts of canopy cover less than five acres of varying crown sizes were grouped and classified using the predominate crown class; for example, if an area of large crown trees less than 5 acres was adjacent to a medium crown area greater than 5 acres, the entire area was considered one contiguous tract and classified as medium crown trees.

Final Field Reconnaissance

A *Certified Forester* and a *Certified Arborist* conducted field inspections of public access sites in the county representing the range of forest crown classes identified to evaluate the accuracy of the forest delineations.

Assessment Limitations

For the purposes of this study, forest tracts over five acres in size with greater than 10% canopy cover were mapped. Areas not mapped as forest include: residential landscaping and maintained backyards; active areas of golf courses; cemeteries; street trees; fencerows (unless they are a natural and significant extension of a forest tract greater than five acres); and other non-forest properties. Forest canopy was primarily analyzed and delineated on non-developed property; however, public parks were included in the analysis.

The most current aerial photographs available for Kenton County at the time of this study were from 1999. It is reasonable to assume that in the subsequent five years, some of the mapped forest tracts may have been eliminated or reduced by land development activities in the county. The analysis is, therefore, accurate only for the existing forest tract locations and sizes in 1999.

Data Summaries and Findings

County Summaries

Table 2 displays the countywide forest canopy cover data revealed by the analysis of the digital orthophotographs and field verifications. The forest quality assessment map is shown in Appendix C.

Table 2. Forest Canopy Coverage in Kenton County

Canopy Cover Type	Area (Acres)	% of Total Canopy Cover	% of Kenton County
Small Crown	26,997	62%	26%
Medium Crown	14,539	34%	14%
Large Crown	1,804	4%	2%
Total	43,340		41%

Kenton County has approximately 43,340 acres of forest cover, which represents 41% of the total land in the county. Of that amount, 26,997 acres are in the small crown class, representing 62% of the total canopy cover and 26% of the land area. The medium crown class is found on 14,539 acres, representing 34% of the total canopy cover and 14% of the total land area. The large crown class is found on 1,804 acres, representing 4% of the total canopy cover and 2% of the total land area within the county.

Watershed Summaries

Table 3 displays the Kenton County forest canopy cover data within the nineteen watersheds in the county. The watershed boundaries are shown in Appendix D.

Table 3. Forest Canopy Coverage in Kenton County by Watershed and Crown Size

Watershed	Watershed Totals			Small Crowns		Medium Crowns		Large Crowns	
	Total Area (acres)	Canopy Cover (acres)	% of Canopy Cover	Area (acres)	% of Total	Area (acres)	% of Total	Area (acres)	% of Total
Grassy Creek	135	57	42%	57	99%	<1	<1%	-	-
Wolf Pen Branch	926	182	20%	120	66%	62	34%	-	-
McCoys Fork	1,257	238	19%	117	49%	122	51%	-	-
Holds Branch	1,496	666	45%	131	20%	535	80%	<1	<1%
Trace Run	1,895	897	47%	491	55%	405	45%	-	-
Brushy Fork	3,326	1,080	32%	684	63%	338	31%	58	5%
Horse Branch	2,680	1,093	41%	490	45%	462	42%	141	13%
Sawyers Fork	2,824	1,314	47%	1,250	95%	64	5%	-	-
Steep Creek	2,812	1,659	59%	1,317	79%	267	16%	75	5%
Little Cruises Creek	2,794	1,736	62%	1,347	78%	389	22%	-	-
Fowler Creek	5,056	1,749	35%	1,178	67%	570	33%	<1	<1%
Bullock Pen Creek	7,500	2,304	31%	834	36%	1,106	48%	364	16%
DeCoursey Creek	5,587	2,746	49%	1,031	38%	1,565	57%	149	5%
Ohio River	13,040	3,422	26%	1,844	54%	1,128	33%	450	13%
N. Fork Grassy Creek	8,119	3,981	49%	3,528	89%	453	11%	-	-
Bowman Creek	8,076	4,607	57%	3,549	77%	1,022	22%	36	1%
Licking River	10,189	4,904	48%	2,967	60%	1,675	34%	262	5%
Banklick Creek	14,013	4,954	35%	1,935	39%	2,774	56%	246	5%
Cruises Creek	12,991	5,750	44%	4,127	72%	1,602	28%	21	0%
Totals	104,716	43,340	41%	26,997	62%	14,539	34%	1,804	4%

The largest watersheds within Kenton County and their respective percentage of canopy cover include: Banklick Creek (35%); Ohio River (26%); Cruises Creek (44%); and the Licking River (48%).

No watershed was completely forested and no watershed was devoid of forest cover. The watersheds with the highest percentage of forest canopy cover include: Little Cruises Creek (62%); Steep Creek (59%); and Bowman Creek (57%). The watersheds with the lowest percentage of forest canopy cover include: McCoys Fork (19%); Wolf Pen Branch (20%); and Ohio River (26%).

The watersheds with the highest acreage of forest canopy cover include: Cruises Creek (5,750 acres; 44%); Banklick Creek (4,954; 35%); and Licking River (4,904 acres; 48%). The watersheds with the lowest acreage of forest canopy cover include: Grassy Creek (57 acres; 42%); Wolf Pen Branch (182 acres; 20%); and McCoys Fork (238 acres; 19%).

The watersheds with the highest acreage of small crown trees include: Cruises Creek (4,127 acres; 72%); Bowman Creek (3,549 acres; 77%); and North Fork Grassy Creek (3,528 acres; 89%).

The watersheds with the highest acreage of medium crown trees include: Banklick Creek (2,774 acres; 56%); Licking River (1,675 acres; 34%); and Cruises Creek (1,602 acres; 28%).

The watersheds with the highest acreage of large crown trees include: Ohio River (450 acres; 13%); Bullock Pen Creek (364 acres; 16%); and Licking River (262 acres; 5%).

Municipal and Unincorporated Area Summaries

Table 4 displays the Kenton County forest canopy cover data within the twenty-one municipalities and the remaining unincorporated areas in the county. A map showing the locations of the municipalities and unincorporated areas is shown in Appendix E.

Table 4. Forest Canopy Cover in Kenton County by Government Unit

Government Unit	Government Unit Totals			Small Crowns		Medium Crowns		Large Crowns	
	Total Area (acres)	Canopy Cover (acres)	% of Canopy Cover	Area (acres)	% of Total	Area (acres)	Area (acres)	% of Total	Area (acres)
Kenton Vale	33	15	45%	6	43%	8	57%	-	-
Visalia	159	23	14%	23	99%	-	-	<1	1%
Lakeside Park	508	50	10%	26	52%	24	48%	-	-
Walton	221	65	29%	36	55%	29	45%	-	-
Latonia Lakes	168	77	46%	45	58%	31	41%	1	1%
Park Hills	493	91	18%	29	32%	57	63%	5	5%
Bromley	323	92	28%	64	70%	28	30%	-	-
Ludlow	814	150	18%	111	74%	37	25%	2	2%
Crestview Hills	1,238	205	17%	149	73%	55	27%	1	<1%
Crescent Springs	936	288	31%	153	53%	117	41%	18	6%
Fairview	469	333	71%	35	11%	298	89%	-	-
Elsmere	1,620	393	24%	168	43%	214	55%	10	3%
Fort Mitchell	1,992	699	35%	282	40%	265	38%	152	22%
Fort Wright	2,202	781	35%	211	27%	406	52%	163	21%
Villa Hills	2,791	814	29%	732	90%	78	10%	5	1%
Edgewood	2,744	918	33%	330	36%	406	44%	182	20%
Taylor Mill	3,915	1,899	49%	699	37%	1,069	56%	131	7%
Erlanger	5,402	2,002	37%	898	45%	921	46%	183	9%
Ryland Heights	3,401	2,225	65%	1,200	54%	1,013	46%	12	1%
Covington	8,716	3,096	36%	989	32%	1,828	59%	279	9%
Independence	11,307	3,675	32%	1,830	50%	1,488	40%	356	10%
Unincorporated	55,282	25,449	46%	18,981	75%	6,165	24%	304	1%
Totals	104,735	43,340	41%	26,997	62%	14,539	34%	1,804	1%

The twenty-one municipalities combined represent 49,453 acres, or 47% of the total land area in Kenton County. The unincorporated areas comprise the balance of the total land area with 55,282 acres, or 53% of county. The majority of forest cover (25,449 acres; 59%) is found in the unincorporated areas; the remaining forest cover (17,891; 41%) is found in the municipalities. These statistics also indicate that, as a whole, the municipal areas are 36% forested and the unincorporated areas are 46% forested.

The municipalities with the most acreage of forest canopy cover include: Independence (3,675 acres; 32%); Covington (3,096 acres; 6%); Ryland Heights (2,225 acres; 65%); Erlanger (2,002 acres; 37%); and Taylor Mill (1,899 acres; 49%).

The municipalities with the least acreage of forest canopy cover include: Kenton Vale (15 acres; 45%); Visalia (23 acres; 14%); Lakeside Park (50 acres; 10%); Walton (65 acres; 29%); and Latonia Lakes (77 acres; 46%).

The municipalities that have the highest total forest cover as percentage of their incorporated land area include: Fairview (71%); Ryland Heights (65%); and Taylor Mill (49%). The municipalities that have the least forest cover as percentage of their incorporated land area are: Lakeside Park (10%); Visalia (14%); and Crestview Hills (17%).

The municipalities with the highest acreage of small crown trees include: Independence (1,830 acres; 50%); Ryland Heights (1,200 acres; 54%); and Covington (989 acres; 32%).

The municipalities with the highest acreage of medium crown trees include: Covington (1,828 acres; 59%); Independence (1,488 acres; 40%); and Taylor Mill (1,069 acres; 56%).

The municipalities with the highest acreage of large crown trees include: Independence (356 acres; 10%); Covington (279 acres; 9%); Erlanger (183 acres; 9%); and Edgewood (182 acres; 20%).

Discussion

General Forest Quality

Small Crown Forests

The majority of forest cover in Kenton County is classified as *small crown*, further defined as forests with trees less than 12 inches diameter at breast height (dbh). The small crown forests cover 26,997 acres, representing 62% of the total canopy cover and 26% of the land area of Kenton County.

These trees and forest areas are generally less than 25 years old and are found throughout the County, but primarily in the central and southern regions. These forests are typically found on abandoned or idle agricultural land, along riparian corridors without steep slopes, and on land recently disturbed for road construction and other development.



Photograph 1. Small crown class forests are found on previously disturbed land throughout the County.

The small crown class forests are comprised primarily of pioneer species, such as black locust, eastern red cedar, hackberry, elm, and box elder. There is little to no understory except for honeysuckle, grasses, and other plants that may be termed as invasive plants and/or noxious weeds.

If left undisturbed, these areas will eventually mature and change during the natural vegetation succession process. Since most of these sites have been disturbed by human activity, such as farming and construction, as opposed to natural disturbances, such as fire and storms, the conversion of these areas into high-quality, large diameter forests may be significantly delayed.

Medium Crown Forests

The second largest classification of forest cover in Kenton County is *medium crown*, further defined as forests with trees between 12 to 18 inches dbh. The medium crown class is found on 14,539 acres, representing 34% of the total canopy cover and 14% of the total land area in Kenton County.

These trees and forest areas are generally less than 50 years old and are found throughout the County, but in heavier concentrations in the east central region. These forests are typically found on abandoned or idle agricultural land and along riparian corridors with steeper slopes.



Photograph 2. Typical view of a medium crown class forested area.

The medium crown class in Kenton County is still comprised primarily of primary successional tree species, such as elm, box elder, black locust, and hackberry. However, because of their size and age, other species, more typical of secondary succession, can also be found. These species include red oak, white oak, sugar maple, and hickory. Additionally, the understory has a more diverse species composition of plants indicating a higher quality ecosystem, such as spicebush, redbud, hawthorn, and native herbaceous plants. Due to the forest fragmentation and increasing urbanization, invasive plants, such as honeysuckle, multiflora rose, ailanthus, euonymus, and garlic mustard, are prevalent in the medium crown class forests.

Large Crown Forests

The smallest classification of forest cover in Kenton County includes the *large crown* forests, further defined as forests with trees 18 inches dbh and larger. The large crown class is found on 1,804 acres, representing 4% of the total canopy cover and 2% of the total land area within Kenton County.

These trees and forest areas are generally older than 50 years and are found primarily in the northern half of the County. Thirty-one (31) distinct large canopy forest units were identified by the analysis. The largest of these forest tracts are found in and near Devou Park, the Liking River, and Doe Run Lake. These forests are typically found on steep slopes, in riparian and river corridors, and on publicly owned properties, such as parks.



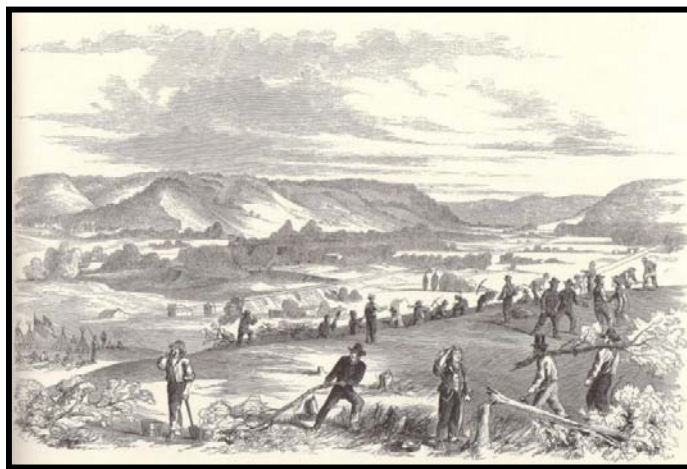
*Photograph 3. This area of large canopy trees is found near Doe Run Lake.
Large diameter trees are found in only 2% of Kenton County.*

The large crown class in Kenton County is comprised primarily of secondary and climax successional tree species, such as sugar maple, red maple, American beech, red oak, white oak, basswood, shagbark hickory, pignut hickory, butternut hickory, sycamore, white ash, green ash, yellow poplar, and red elm. In addition, the understory has a diverse species composition of plants indicating a higher quality ecosystem, such as elderberry, paw paw, dogwood, witchhazel, spicebush, redbud, hawthorn, and native herbaceous plants. However, due to the forest fragmentation and increasing urbanization, invasive plants such as honeysuckle, multiflora rose, ailanthus, euonymus, and garlic mustard are found in the large crown class forests as well.

The majority of the large canopy crown forests in Kenton County are truly islands—separated from each other by great distances and isolated from other forest units by roads and development. The large crown areas in particular should be studied in more detail. For instance, it would be valuable for future management efforts to determine whether they are in public or private ownership. Conducting a vegetation inventory on a more precise level and identifying the true forest and understory species composition will provide additional data regarding the presence of rare, threatened, or endangered species and a more accurate assessment of forest quality.

Historical Comparisons

Kenton County was established in 1840, yet was being settled by humans well before that time. Due to its location near Cincinnati along the Ohio River and the Licking River and its relative gentle topography in southern section of the county, settlement, agriculture, and commerce were major forces in shaping the land and developing Kenton County.



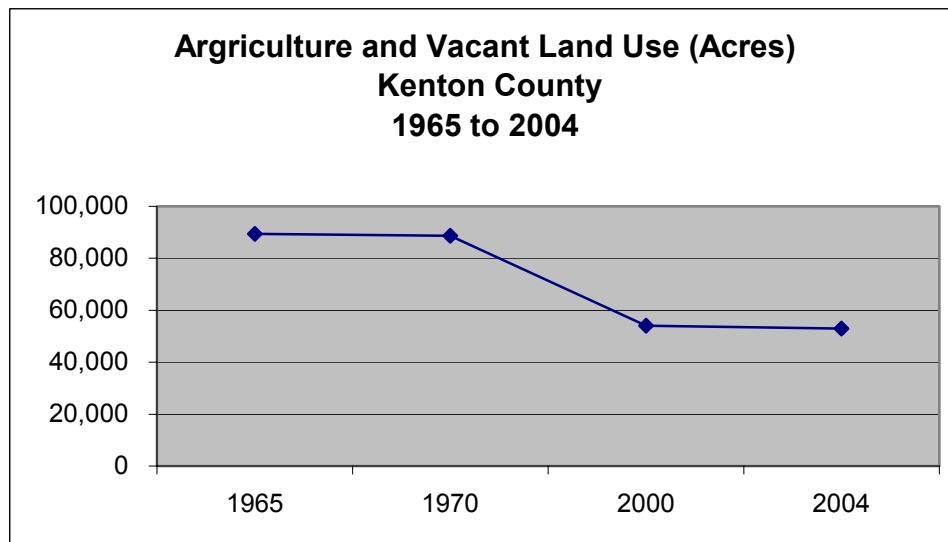
*Figure 1. Tree Clearing at Tunnel Hill, near Covington
(Frank Leslie's Illustrated, October 4, 1862).*

It is assumed that Kenton County, much like the other counties in the Ohio River Valley, were primarily forest-covered at the time of settlement. Once settlement began, the landscape changed rapidly from forests to farms and towns. The original forest was cleared and harvested to fuel a growing population and economy.

There are forest remnants of large diameter trees in the County. It is unlikely, however, that any of these are true old-growth or original forest stands. More likely, these areas are second or even third growth forests remaining untouched since the last historic timber harvest or agricultural clearing activity.

Using aerial photographs from 1954 and comparing them to the 1999 aerial photographs, a qualitative statement can be made that the forest cover has increased only slightly in that 46-year period. Agricultural land use declined during that period, and as fields were left idle, forests began to reemerge as the primary vegetative cover. However, during that same time, land development for residential and business use increased, and new and old forest stands were removed.

Confirming this conclusion is historic land use data compiled by the Northern Kentucky Area Planning Commission (NKAPC). In 1965, the total acreage of *Agriculture* and *Vacant* land use in Kenton County was 89,635 acres (85% of the County's land area); in 2004, there was a total of 52,952 acres (50% of County's land area). This represents a 41% loss of a land use that would support forest cover over the last forty years, as shown in the chart below.



2003 U. S. Forest Service Forest Inventory and Analysis Program

In 2003, the United States Forest Service (USFS) completed a comprehensive Forest Inventory and Analysis (FIA) project across the country. The FIA program of the Forest Service has been in continuous operation since 1930 with a mission to "make and keep current a comprehensive inventory and analysis of the present and prospective conditions of and requirements for the renewable resources of the forest and rangelands of the United States."

Kenton County is located in the Southern Region of USFS management units. County forest data from the Southern Research Station, FIA Research Unit was made publicly available in 2004.

Although not part of the scope of this project, data from the FIA relevant to the Kenton County Forest Quality Assessment project is presented in this report for information purposes. Information and a reference to the FIA are included in Appendix F.

Highlights and summaries of the FIA for Kenton County include the following:

1. The 2003 FIA classified Kenton County as having 26,040 acres of forest, or 25% canopy cover, using USFS data and methodologies.
2. Since the 1988 FIA, Kenton County's forest has neither increased nor decreased by 5% or less.
3. All timberland is held in private ownership.
4. Three predominant species mixes comprise the County's forest cover: white oak/red oak/hickory (67%); sassafras/persimmon (16.5%); and elm/ash/locust (16.5%).
5. The 2003 FIA classified 19,523 acres (75%) as *Large Diameter* stands, 5,425 acres (21%) as *Medium Diameter* stands, and 1085 acres (4%) as *Small Diameter* stands.
6. All timberland was rated within the Site Productivity Class 50-84; this is a low rating on a scale of 0 to greater than 225.
7. Of the timberland within the county, the FIA deemed 13% to be *Fully Stocked*, 67% to be *Medium Stocked*, 16% to be *Poorly Stocked*, and 4% to be *Nonstocked*.

More information about the Forest Inventory and Analysis project can be obtained from the U. S. Forest Service and the State Division of Forestry.

Conclusion

Rural and urban forest resources are important components of Kenton County's ecological health, environmental quality, aesthetics, and livability. Rural forests, their canopy cover, and associated plant and animal communities contribute many benefits and much value to the County. They help stabilize soil by controlling wind and water erosion, reduce noise levels, cleanse pollutants from the air, produce oxygen and absorb carbon dioxide, provide wildlife habitat, improve water quality by filtering soil and pollutants, and provide places for residents and visitors to recreate, relax, and learn. Urban forests also provide many of the same benefits and contribute significant economic benefits through increased real estate values, improved settings for business activities, and reduced energy costs for heating and cooling.

The Kenton County Forest Quality Assessment revealed that 41% of the County is forested or has a canopy cover of various densities. The breakdown of this canopy coverage is 26% small crown trees, 14% medium crown trees, and 2% large crown trees. The greatest benefits derived from forests are found in the high-quality ecosystems associated with large canopy trees. Clearly, Kenton County lacks this type of forest cover.

The municipalities average 36% canopy covered, with a range of 10% to 71%. The national average is 27% canopy cover in cities. Although the average for Kenton County's municipalities exceeds the national average, it does not meet the American Forestry Association's recommendations. The American Forestry Association, through research and numerous studies, has determined that a 60% canopy cover in low-density residential areas, 40% in high-density residential areas, 25% in mixed commercial-use areas, and 10% in highly-urbanized, downtown areas is desirable to obtain the many benefits of urban forests.

Given the land uses and characteristics of the diversity of municipalities in Kenton County, a goal could be to achieve an average 40% canopy cover. Sixteen municipalities have canopy cover below this goal, and only six exceed this goal.

The Kenton County Forest Quality Assessment has quantified and located the forest resources in the County's municipalities, watersheds, and unincorporated areas. This information is valuable for current and future community planning and visioning efforts, as the forest resources within the County should be a major consideration of any future plans. The collective benefits Kenton County receives from its forests can only be derived and maximized from careful planning, protection, and management of these valuable resources.

Appendix A
Field Verification Sites Map



Field Verification Sites

Kenton County, Kentucky

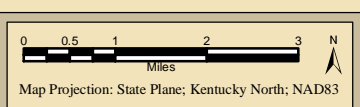
The location and forest quality assessment data were developed by Davey Resource Group.

Roads, hydrology, and county, municipality, and watershed boundaries were provided by Northern Kentucky Area Planning Commission.

The forest quality assessment was supported by generous contributions from the Greater Cincinnati Foundation, U.S. Forest Service. Additional support was provided by the Northern Kentucky Urban and Community Forestry Council and Kentucky Division of Forestry.



	Field Verification Sites
	Major Highways
	Primary Roads
	Secondary Roads
	Local Roads
	Railroads
	Streams
	Open Water
	City Boundary
	County Boundary
Canopy Size	
	Large
	Medium
	Small



Appendix B
Representative Photographs of the Field Verification Sites



Photograph 1. Site 6, example of low density, small crown forest cover.



Photograph 2. Site 5, example of low density, medium crown forest cover.



Photograph 3. Site 7, example of low density, large crown forest cover.



Photograph 4. Site 11, example of low density, large crown forest cover.



Photograph 5. Site 2, example of high density, small crown forest cover.



Photograph 6. Site 3, example of high density, medium crown forest cover.



Photograph 7. Site 8, example of high density, medium crown forest cover.



Photograph 8. Site 9, example of high density, medium crown forest cover.



Photograph 9. Site 9, example of high density, large crown forest cover.



Photograph 10. Site 9, example of high density, large crown forest cover.

Appendix C
Forest Quality Assessment Map



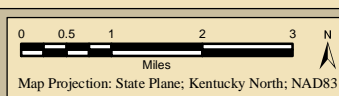
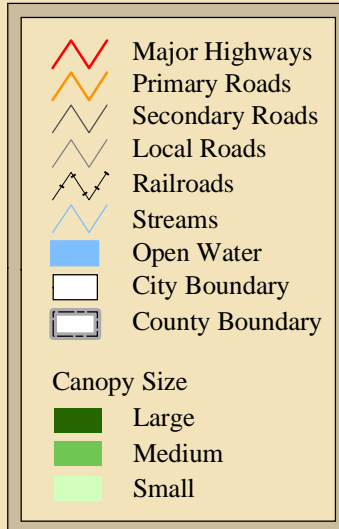
Forest Quality Assessment

Kenton County, Kentucky

The location and forest quality assessment data were developed by Davey Resource Group.

Roads, hydrology, and county, municipality, and watershed boundaries were provided by Northern Kentucky Area Planning Commission.

The forest quality assessment was supported by generous contributions from the Greater Cincinnati Foundation, U.S. Forest Service. Additional support was provided by the Northern Kentucky Urban and Community Forestry Council and Kentucky Division of Forestry.



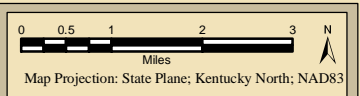
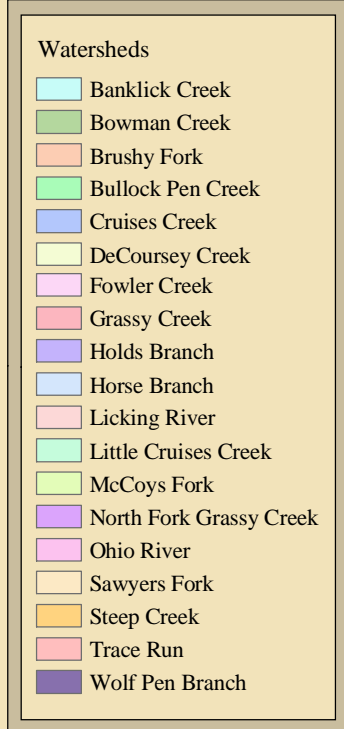
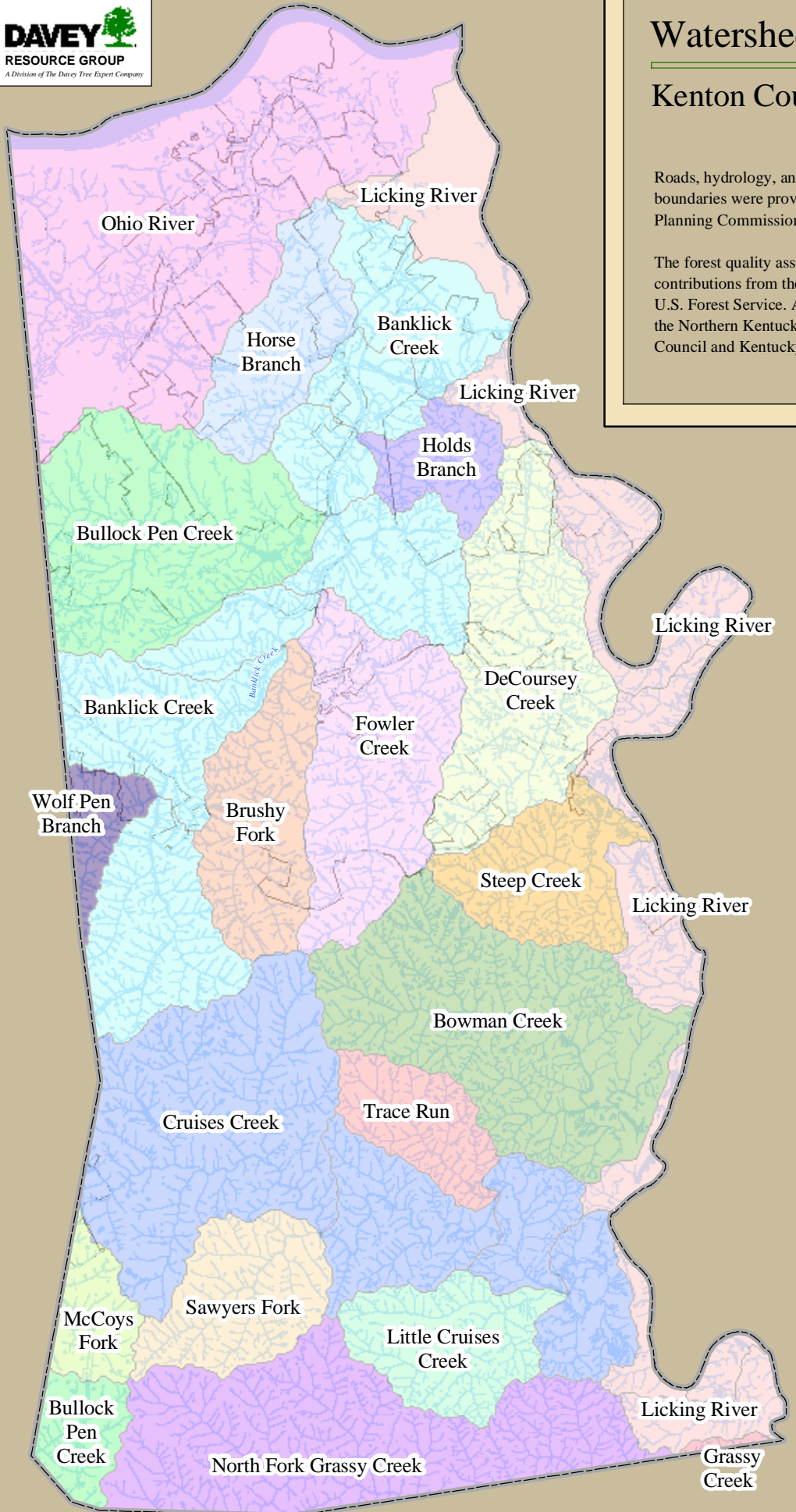
Appendix D
Watershed Boundaries Map

Watersheds Boundaries

Kenton County, Kentucky

Roads, hydrology, and county, municipality, and watershed boundaries were provided by Northern Kentucky Area Planning Commission.

The forest quality assessment was supported by generous contributions from the Greater Cincinnati Foundation, U.S. Forest Service. Additional support was provided by the Northern Kentucky Urban and Community Forestry Council and Kentucky Division of Forestry.



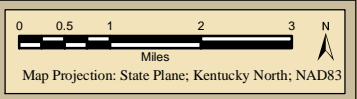
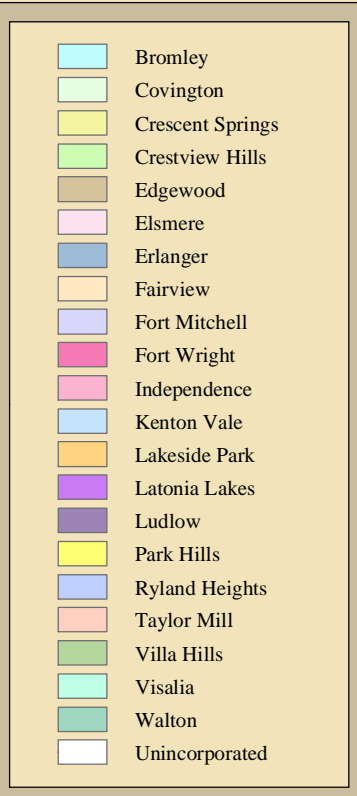
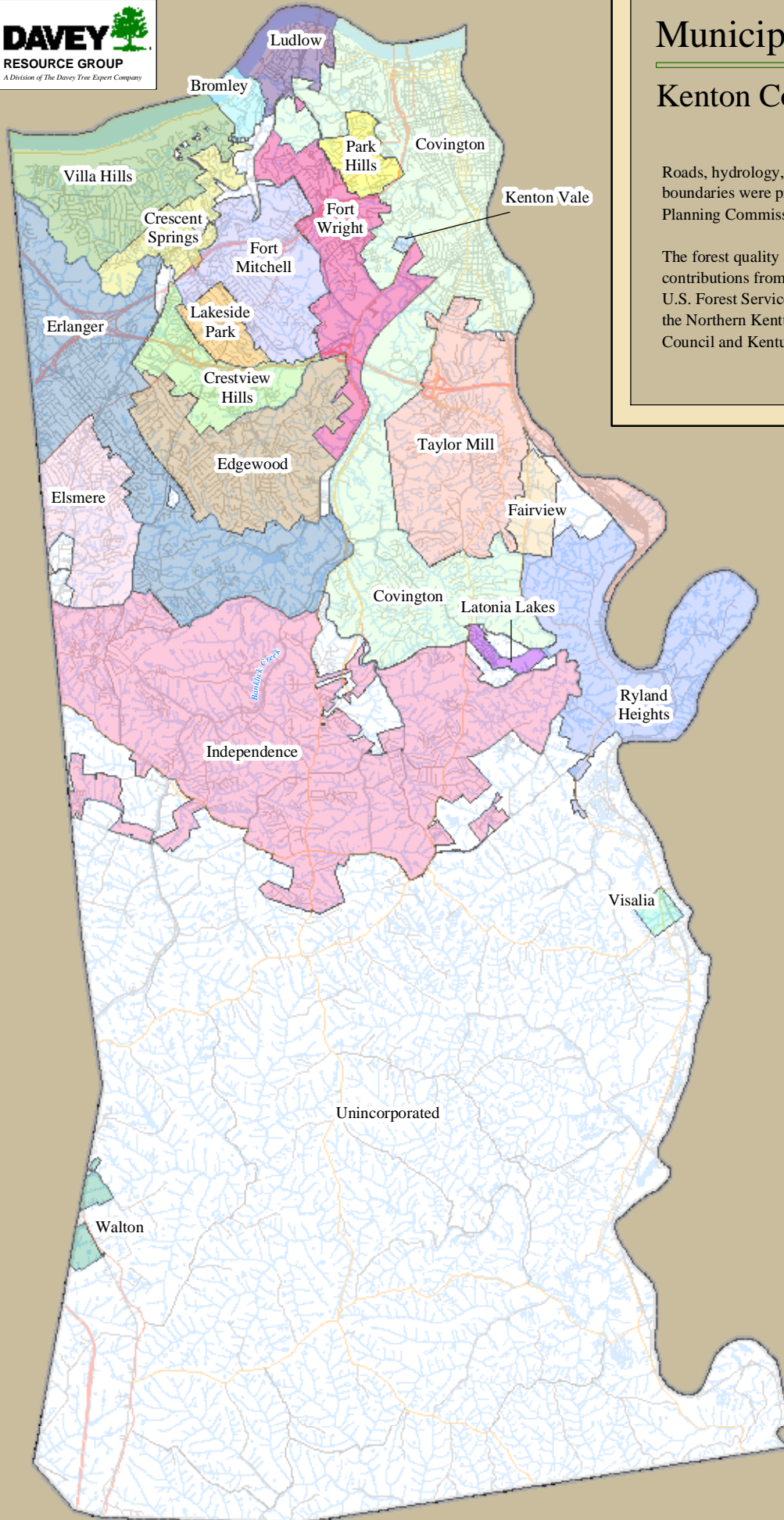
Appendix E
Municipality Boundaries Map

Municipality Boundaries

Kenton County, Kentucky

Roads, hydrology, and county, municipality, and watershed boundaries were provided by Northern Kentucky Area Planning Commission.

The forest quality assessment was supported by generous contributions from the Greater Cincinnati Foundation, U.S. Forest Service. Additional support was provided by the Northern Kentucky Urban and Community Forestry Council and Kentucky Division of Forestry.



Appendix F
USFS FIA Report

Highlights of the 2003 Kentucky Forest Inventory

Forestland Area

Kentucky's forests cover 11.9 million acres or 47 percent of the State. This is a decrease of 769,000 acres, a 3 percent net loss, since the previous forest inventory in 1988. Ninety-seven percent of the forest land is considered available for timber production. The remaining forest land area is unproductive forestland and reserved forestland where timber removals are prohibited by law.

Area by land class (thousands of acres)

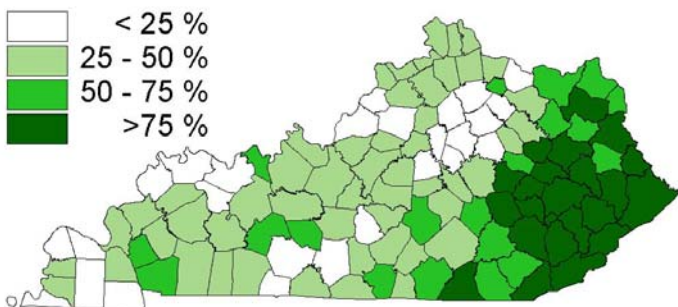
Land Class	1949	1963	1975	1988	2003
Timberland	11,446	11,713	11,902	12,347	11,624
Other/reserved	51	142	259	352	306
Total forest land	11,497	11,855	12,161	12,699	11,930
Total land area*	25,513	25,512	25,504	25,388	25,426
Percent forested	45%	46%	48%	50%	47%

* Estimates of the total land area have changed because of new measurement techniques and refinements in the classification of small bodies of water and streams.

Forest Distribution

The Cumberland Plateau and the Appalachians in the eastern portion of the state is the most heavily forested. The central and western portions of the state, although less densely forested, account for 50 percent of the total forestland area.

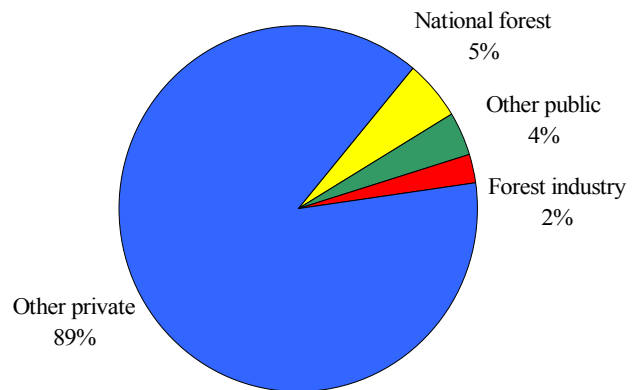
Percentage of land in forest by county



Ownership of the Forest

Private landholders are the dominant owners of Kentucky's timberland. Nine percent is public land, administered by local, state or federal agencies. Slightly more than half of the public land is managed by the US Forest Service. Forest industry accounts for the remaining 2 percent of timberland.

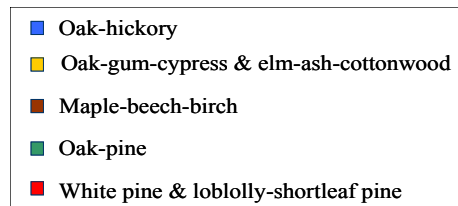
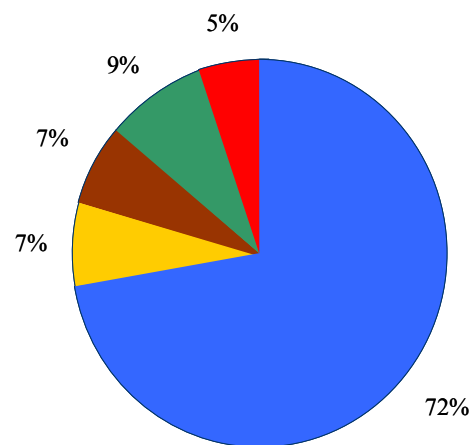
Ownership of timberland



Forest Type Composition

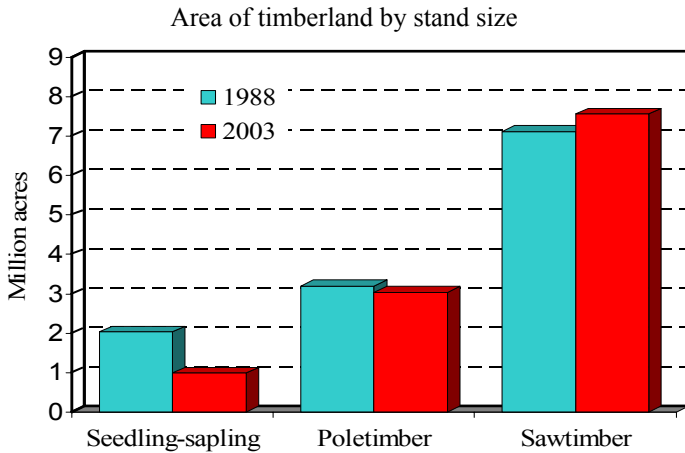
Oak-hickory is the predominant forest type in the state, covering 8.4 million acres (72 percent of the timberland).

Area of timberland by forest type group



Stand Size Distribution

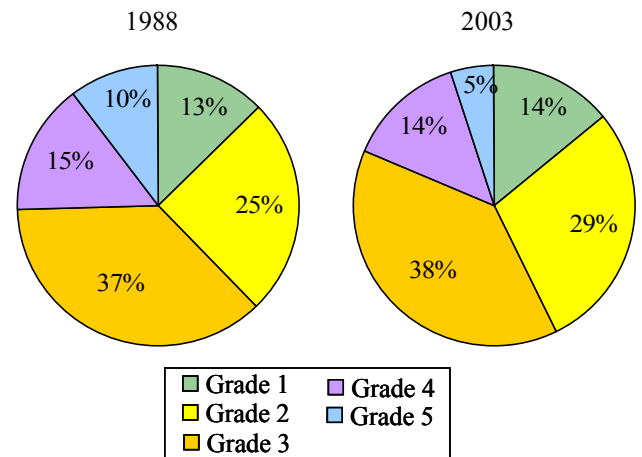
There has been a 6 percent increase in the number of acres in sawtimber size stands on Kentucky's timberland. Sawtimber stands cover 65 percent of the timberland in the state. The number of acres of poletimber stands declined by 5 percent, while the acres of sapling-seedling stands declined by half.



Hardwood Tree Grade Distribution

The percentage of board foot volume in tree grades 1 and 2 increased by 5 percent since 1988. The percentage of board foot volume in the lower quality grades 4 and 5 declined from 25 to 19 percent.

Percentage of hardwood growing stock board foot volume by tree grade

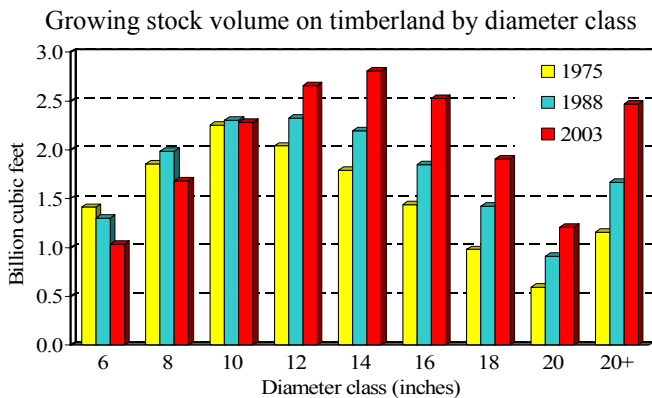


Tree Volume

In spite of the reduction in forest area, growing stock volume on timberland has increased from 16.0 billion cubic feet in 1988 to 18.6 billion cubic feet in 2003. The volume in sawtimber size trees increased from 45.8 to 62.0 billion board feet.

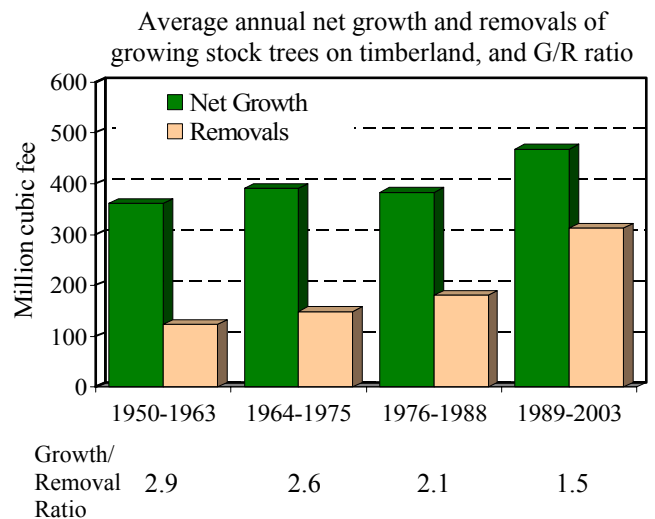
Volume Distribution by Diameter Class

The increase in volume is due to the growth on trees 12 inches and greater in diameter.



Growth, Removals and Mortality

The net growth of Kentucky's growing stock volume averaged 468.5 million cubic feet yearly since 1988. Net growth accounts for mortality, which averaged 182.7 million cubic feet annually or 1.0 percent of the current inventory. Timber removals averaged 311.8 million cubic feet annually. The growth to removal ratio is 1.5.



Statistical Reliability Kentucky 2003 FIA Data

A measure of reliability of inventory statistics is provided by sampling errors. These sampling errors mean that the chances are two out of three that the true population value is within the limits indicated by a confidence interval. Sampling errors (in percent) and associated confidence intervals around the sample estimates for timberland area and inventory volumes are presented in the following table.

Item	Sample estimate and confidence interval	Sampling error (Percent)
Timberland (1,000 acres)	11,623.9 ± 50.4	0.43
All live (million cubic ft)		
Inventory	21,584.6 ± 371.2	1.72
Growing stock (million cubic ft)		
Inventory	18,582.3 ± 360.4	1.94
Net annual growth	468.1 ± 14.1	3.02
Annual removals	311.8 ± 25.8	8.26
Annual mortality	182.7 ± 13.0	7.12
Sawtimber (million board ft)		
Inventory	62,034.8 ± 1,856.3	2.99

FIA inventories supported by the full complement of sample plots are designed to achieve reliable statistics at the survey unit and State levels. Sampling error increases as the area or volume considered decreases in magnitude. Sampling errors and associated confidence intervals are often unacceptably high for small components of the total resource. Statistical confidence may be computed for any subdivision of State totals using the following formula.

$$SE_s = SE_t \frac{\sqrt{X_t}}{\sqrt{X_s}}$$

Where

SE_s = sampling error for subdivision of State total,

SE_t = sampling error for State total,

X_s = sum of values for the variable of interest (area or volume) for subdivision of State,

X_t = total area or volume for State.

Sampling errors obtained from this method are only approximations of reliability because this process assumes constant variance across all subdivisions of totals.

For example, the estimate of sampling error for the area of timberland owned by forest industry is computed as:

$$SE_s = 0.43 \frac{\sqrt{11,623.9}}{\sqrt{285.1}} = 2.75$$

Thus, the sampling error is 2.75 percent, and the resulting confidence interval of one standard error (two times out of three) for area of timberland owned by forest industry is 285.1 ± 7.8 thousand acres. To achieve the ninety-five percent confidence interval, the standard error is multiplied by 1.96 or 285.1 ± 15.4 thousand acres.

Precautions

Traditional users of FIA data are accustomed to the highly variable accuracy of small subsets of population totals. All FIA published reports devote a chapter that explains sampling errors and provide cautions about the reliability of subpopulations such as county-level statistics. Therefore, when summarizing statistics from the FIADB, it is strongly recommended that users beware of any subdivision below the survey unit level. Users should familiarize themselves with the procedures to compute sampling error as outlined above.

Definitions of Terms

Average annual gross growth. Average annual increase in volume of trees 5.0 inches d.b.h. and larger in the absence of cutting and mortality. Gross growth includes survivor growth, ingrowth, growth on ingrowth, growth on removals before removal, and growth on mortality before death.

Average annual mortality. Average annual volume of trees 5.0 inches d.b.h. and larger that died from natural causes during the intersurvey period.

Average annual net growth. Average annual net change in volume of trees 5.0 inches d.b.h. and larger in the absence of removals during the intersurvey period. Average annual net growth is equal to Average annual gross growth minus average annual mortality.

Average annual removals. Average annual volume of trees 5.0 inches d.b.h. and larger removed from the inventory by harvesting, cultural operations, (such as timber-stand improvement), land clearing, or changes in land use during the intersurvey period.

Average net annual change. Increase or decrease in volume of live trees at least 5.0 inches d.b.h. Net annual change is equal to net annual growth minus average annual removals.

D.b.h. Tree diameter in inches (outside bark) at breast height (4.5 feet above ground level).

Forest land. Land at least 10 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use. The minimum area considered for classification is 1 acre. Forested strips must be at least 120 feet wide.

Forest industry. Companies or individuals operating primary wood-using plants.

Forest type. A classification of forest land base on the species forming a plurality of live tree stocking.

Growing stock trees. Live trees that contain at least one 12-foot or two 8-foot logs in the sawlog portion, either currently or potentially if too small to qualify as a sawlog. The log(s) must meet dimension and merchantability standards to qualify. Trees must have one-third of the gross board foot volume in sound wood, either currently or potentially.

Growth to removal ratio. Comparison of the amount of growth volume to the amount of volume removed by human activity, including harvesting, land clearing, or changes in land use during the intersurvey period. The growth to removal ratio is equal to the average net annual growth divided by average net annual removals. If the ratio is greater than one, then wood volume is being added to the inventory. If it is less than one, then the inventory is decreasing.

Hardwoods. Dicotyledonous trees, usually broadleaf and deciduous.

Nonforest land. Land that either has never supported forests or land formerly forested that has been developed for other uses, including cultural, agricultural, etc.

Other forest land. Forest land that is incapable of producing 20 cubic feet of wood volume per acre annually under natural conditions due to adverse site conditions such as sterile soils, dry climate, poor drainage, high elevation, steepness, or rockiness.

Other private. Land owned by individuals and corporations, including individual and corporate farms, where the owner does not own a primary wood-using plant. This land is often referred to as nonindustrial private forest land (NIPF).

Poletimber. Softwood species 5.0 to 8.9 inches d.b.h. and hardwoods 5.0 to 10.9 inches d.b.h.

Reserved forest land. Public forest land capable of producing 20 cubic feet of wood volume per acre annually, but is withdrawn from timber utilization through statute or administrative regulation.

Saplings. Trees 1.0 to 4.9 inches d.b.h.

Sawtimber. Softwood species 9.0 inches d.b.h. and larger and hardwoods 11.0 inches d.b.h. and larger.

Seedlings. Trees less than 1.0 inch d.b.h. and greater than 1 foot tall for hardwoods, greater than 6 inches tall for softwoods.

Softwoods. Coniferous trees, usually evergreen, having leaves that are needles or scalelike.

Stand age. The average age of dominant and codominant trees in the stand.

Stand size class. A classification of forest land based on the diameter class distribution of live trees in the stand.

Timberland. Forest land capable of producing 20 cubic feet of wood volume per acre annually and not withdrawn from timber utilization.

Tree. Woody plants having one erect perennial stem or trunk at least 3 inches d.b.h., a more or less definitely formed crown of foliage, and a height of at least 13 feet at maturity.

Tree grade. A classification of the sawlog portion of sawtimber trees based on the grade of the butt log or the ability to produce at least one 12-foot log or two 8-foot logs in the upper section of the sawlog portion. Tree grade is an indicator quality; grade 1 is the best quality.

Volume. The amount of sound wood in live trees at least 5.0 d.b.h. from a 1-foot stump to a minimum 4.0-inch top diameter outside bark of the central stem.

For more information contact:
Forest Inventory and Analysis
Southern Research Station, USDA Forest Service
4700 Old Kingston Pike, Knoxville, TN 37919
Phone: (865) 862 2000 Fax: (865) 862 0262
Southern FIA <http://srsfia2.fs.fed.us>
National FIA <http://fia.fs.fed.us>

Kentucky Division of Forestry
627 Comanche Trail, Frankfort, KY 40601
Phone: (502) 564 4496 Fax: (502) 564 6553
<http://www.forestry.ky.gov>

Appendix G

Davey Resource Group Personnel Profiles

Jennifer L. Gulick, M.A., Project Manager, is a business developer and project manager responsible for assisting governments, businesses, utilities, and non-profit organizations with various project development and implementation plans specializing in urban forestry, park management, and land development programs. Ms. Gulick has over 22 years of experience and joined Davey Resource Group in 1999 after a successful career in municipal government. She is an International Society of Arboriculture *Certified Arborist*, and is a *Certified Forester* as recognized by the Society of American Foresters. Ms. Gulick is also the Immediate Past-President of the Ohio Chapter of the International Society of Arboriculture, President of the Greater Cincinnati Branch of the Professional Grounds Management Society, and is a board member of the Kentucky Division of Forestry's Urban Forestry Advisory Council, and the Northern Kentucky Urban & Community Forestry Council. Ms. Gulick received a Bachelor of Science degree in Forest Resource Management from West Virginia University and a Master of Arts degree in public administration from the University of Cincinnati.

Michael R. Binkley, M.A., is a Geographic Information Scientist with ten years of experience applying GIS technology to environmental analysis and natural resource management. Mr. Binkley maintains extensive knowledge of contemporary GIS software as well as their common operating system software and hardware platforms. In addition, he is an experienced programmer with emphasis on Visual Basic and various GIS programming languages. Mike currently supervises GIS operations at Davey. Mike received a master of arts in geography and a bachelor of science with honors in natural resource conservation with minors in climatology and geography from Kent State University. Mike is also a member of several professional organizations; these affiliations include the American Society for Photogrammetry and Remote Sensing, Association of American Geographers, Ohio Academy of Science, American Geophysical Union, and the Water Resources Research Institute.

Shawn W. Bruzda is a biologist and senior urban forester with Davey Resource Group. Mr. Bruzda serves as an inventory arborist for all types of tree inventory projects, including cemeteries, golf courses, military bases, municipalities, parks, and university campuses. Mr. Bruzda is also responsible for the creation and dissemination of tree inventory management plans. He has extensive experience with both GPS and hand-held and pen-based data collection units. He has served as project manager on numerous large-scale municipal tree inventory projects throughout the eastern United States. Recently, he has participated in the collection of data for Street Tree Resource Analysis Tool for Urban Forest Managers (STRATUM). STRATUM, developed by the U.S. Forest Service, is a model used for analyzing benefits of urban street trees as well as the costs of managing them. As a biologist for Davey, Mr. Bruzda is responsible for ecological surveys, fish and macroinvertebrate identification and data analysis, and report writing. He also assists in various other areas such as wetlands delineation surveys, endangered species surveys, tree appraisals and tree preservation planning. He is a Certified Arborist through the International Society of Arboriculture, and a graduate of Kent State University, having received a Bachelor of Science degree in biological sciences with an emphasis in aquatic ecology.

Ana Burns, M.S.E.S., is a biologist responsible for project management, data analysis, and report writing for ecological surveys, watershed studies, park inventories, and other projects. She has experience in wetlands delineations, lake and watershed management, and forestry. In addition, Ms. Burns has experience in aerial photograph interpretation and geographic information systems (GIS). Projects she has managed include the Mentor Marsh Area Special

Area Management Plan, located in Lake County, Ohio (funded by Ohio Department of Natural Resources, Coastal Program) and the East Branch of the Rocky River Greenway Protection Plan, located in Cuyahoga, Medina, and Summit Counties, Ohio (funded by Cleveland Metroparks). She joined Davey Resource Group after working as an environmental planner for a county planning department. In this position, she gained valuable experience in facilitating public participation meetings, developing educational outreach materials, and assisting the Planning Commission and their subcommittees in implementing and enforcing comprehensive plans and zoning ordinances. Ms. Burns also served as the primary liaison for the Historic Preservation Board in her community. Ms. Burns graduated from Indiana University with a Bachelor of Science degree in biology, and holds a Master of Science in environmental science from IU's School of Public and Environmental Affairs

Todd A. Crandall, M.En., is a wetlands scientist that routinely performs wetlands assessments and delineations, and prepares restoration and mitigation plans. He also performs vegetation cover mapping and plant identification, and assists with Section 401 and 404 permits. He is certified for wetlands studies by the U.S. Army Wetlands Delineator Certification Program, and is a certified Professional Wetlands Scientist (PWS) through the Society of Wetland Scientists. He has completed the 40-hour OSHA health and safety training (OSHA Standard 29 CFR 1910.120). He has 14 years of experience and holds a Bachelor of Science degree from Hiram College in biology and a Master of Environmental Science degree from Miami University.

Deborah Sheeler, M.A., has five years of experience and education specializing in GIS Analyses and Natural Hazards research. She is currently a GIS Analyst/Cartographer at Davey, where she focuses on designing, creating, and producing maps through the use of advanced GIS software and automated mapping. In addition to geographic analyses and generating maps, she has experience in the field of aerial photography and remote sensing as a graduate teaching assistant and four years experience in monitoring, maintaining and technical support for pen-based computers. Ms. Sheeler has a master's of arts degree in geography from Kent State University and a bachelor's of science degree in geography from Central Missouri State University with a minor in earth science.

Karen M. Wise, M.S., supervises the Natural Resource Consulting group at Davey. This unit provides comprehensive consulting services to governments, development companies, and engineering/design firms. Services provided include wetlands consulting, endangered species surveys, watershed mapping and planning, and comprehensive urban forestry consulting. Ms. Wise is responsible for business development, client and project management, and supervision of the 16 biologists and urban foresters working within the Natural Resource Consulting group. Ms. Wise is a wetlands biologist by training and has more than 12 years of experience in the fields of wetland ecology, restoration, design, and management. She is particularly versed in wetlands policy and familiar with all aspects of Section 401 and 404 permitting, isolated wetlands regulations, and compensatory mitigation for unavoidable impacts to streams and wetlands. Ms. Wise is active in local chapters of the National Home Builders Association and has served on the land use policy subcommittee. She has attended and presented projects at national meetings of the Society of Wetland Scientists, of which she has been a member throughout her career. She is also a supporting member of The Nature Conservancy (TNC) and has coordinated public-private partnerships to assist TNC in land acquisition and land management at holdings in northern Ohio. Ms. Wise holds a Bachelor of Science degree in biology from Wheeling Jesuit College and a Master of Science degree in natural resources from The Ohio State University.